

What is claimed is:

1. A method for detecting changes in status of a tire in real time, comprising the steps of:
  - (a) providing at least one sensor having an output relating to the length of a changing air gap between the at least one sensor and a sidewall of the tire;
  - (b) providing a stored signature including a plurality of data;
  - (c) reading from the at least one sensor a measured signature including a plurality of data collected from the at least one sensor;
  - (d) determining from the stored signature and the measured signature a deviation value representing a deviation between the stored signature and the measured signature; and
  - (e) determining from the deviation value and a predetermined threshold whether the tire status has changed.
2. A system for detecting changes in status of a tire in real time, comprising the steps of:
  - (a) means for providing at least one sensor having an output relating to the length of a changing air gap between the at least one sensor and a sidewall of the tire;
  - (b) means for providing a stored signature including a plurality of data;
  - (c) means for reading from the at least one sensor a measured signature including a plurality of data collected from the at least one sensor;
  - (d) means for determining from the stored signature and the measured signature a deviation value representing a deviation between the stored signature and the measured signature; and
  - (e) means for determining from the deviation value and a predetermined threshold whether the tire status has changed.
3. A method for detecting in real time changes in status of a tire on a vehicle having at least one other tire, comprising the steps of:
  - (a) providing at least one sensor having an output relating to the length of a changing air gap between the at least one sensor and a sidewall of the tire;
  - (b) providing at least one other sensor having an output relating to the length of a changing air gap between the at least one other sensor and a sidewall of the at least one other tire;

(c) reading from the at least one sensor a measured signature including a plurality of data collected from the at least one sensor;

(d) reading from the at least one other sensor at least one other measured signature including a plurality of data collected from the at least one other sensor;

(e) determining from the measured signature and from the at least one other measured signature a deviation value representing a deviation between the measured signature and the at least one other measured signature; and

(f) determining from the deviation value and a predetermined threshold whether status of the tire has changed.

4. A system for detecting in real time changes in status of a tire on a vehicle having at least one other tire, comprising the steps of:

(a) means for providing at least one sensor having an output relating to the length of a changing air gap between the at least one sensor and a sidewall of the tire;

(b) means for providing at least one other sensor having an output relating to the length of a changing air gap between the at least one other sensor and a sidewall of the at least one other tire;

(c) means for reading from the at least one sensor a measured signature including a plurality of data collected from the at least one sensor;

(d) means for reading from the at least one other sensor at least one other measured signature including a plurality of data collected from the at least one other sensor;

(e) means for determining from the measured signature and from the at least one other measured signature a deviation value representing a deviation between the measured signature and the at least one other measured signature; and

(f) means for determining from the deviation value and a predetermined threshold whether status of the tire has changed.

(g) The method for detecting changes in status of a tire in real time according to any of claims 1 or 3, wherein said step of determining from the deviation value and a predetermined threshold whether the tire status has changed comprises the step of determining from the deviation value and a predetermined threshold whether a catastrophic tire failure is imminent.

5. The method for detecting changes in status of a tire in real time according to any of claims 1 or 3, wherein said step of determining from the deviation value and a predetermined threshold whether the tire status has changed comprises the step of determining from the deviation value and a predetermined threshold whether a structural change to the tire has occurred.

6. The method for detecting changes in status of a tire in real time according to any of claims 1 or 3, wherein said step of determining from the deviation value and a predetermined threshold whether the tire status has changed comprises the step of determining from the deviation value and a predetermined threshold whether a change in tire pressure has occurred.

7. The system for detecting changes in status of a tire in real time according to any of claims 2 or 4, wherein said means for determining from the deviation value and a predetermined threshold whether the tire status has changed comprises means for determining from the deviation value and a predetermined threshold whether a catastrophic tire failure is imminent.

8. The system for detecting changes in status of a tire in real time according to any of claims 2 or 4, wherein said means for determining from the deviation value and a predetermined threshold whether the tire status has changed comprises means for determining from the deviation value and a predetermined threshold whether a structural change to the tire has occurred.

9. The system for detecting changes in status of a tire in real time according to any of claims 2 or 4, wherein said means for determining from the deviation value and a predetermined threshold whether the tire status has changed comprises means for determining from the deviation value and a predetermined threshold whether a change in tire pressure has occurred.

10. The method for detecting changes in status of a tire in real time according to any of claims 1 or 3 or 5 or 6 or 7, further comprising the step of providing a warning that a change in tire status has occurred.

11. The system for detecting changes in status of a tire in real time according to any of claims 2 or 4 or 9 or 10 or 11, further comprising means for providing a warning that a change in tire status has occurred.

12. A method for determining tire pressure in real time, comprising the steps of:

- (a) providing at least one sensor having an output relating to the length of a changing air gap between the at least one sensor and a sidewall of the tire;
- (b) reading from the at least one sensor data relating to a length of an air gap between the at least one sensor and a sidewall of the tire;
- (c) determining a measured pressure value for the tire from the data relating to a length of an air gap between the at least one sensor and a sidewall of the tire.

13. A method for determining tire pressure in real time according to claim 13 wherein said step of determining a measured pressure value for the tire from the data relating to a length of an air gap between the at least one sensor and a sidewall of the tire comprises the steps of:

- (a) calculating a derived value relating to the length of the air gap between the at least one sensor and a sidewall of the tire; and
- (b) converting the derived value to the measured pressure value for the tire.

14. A method for determining tire pressure in real time according to claim 14 wherein said step of converting the derived value to the measured pressure value for the tire comprises the steps of:

- (a) providing a lookup table having stored values of tire pressure values as a function of at least a value relating to a length of an air gap between the at least one sensor and a sidewall of the tire; and
- (b) using said lookup table in a process of calculating the measured pressure value for the tire from the derived value.

15. A method for determining tire pressure in real time according to claim 14 wherein said step of converting the derived value to the measured pressure value for the tire comprises the steps of:

- (a) providing a lookup table having stored values of tire pressure values as a function of at least vehicle speed and a value relating to a length of an air gap between the at least one sensor and a sidewall of the tire; and

(b) using said lookup table in a process of calculating the measured pressure value for the tire from the derived value.

16. A method for determining tire pressure in real time according to claim 14 wherein said step of converting the derived value to the measured pressure value for the tire comprises the steps of:

(a) providing a lookup table having stored values of tire pressure values as a function of at least load on the tire, vehicle speed, and a value relating to a length of an air gap between the at least one sensor and a sidewall of the tire; and

(b) using said lookup table in a process of calculating the measured pressure value for the tire from the derived value.

17. The method of any of claims 1 or 3, wherein step (d) comprises: comparing one or more data values associated with one or more corresponding poles in the stored signature and the measured signature.

18. The system of any of claims 2 or 4, wherein the deviation value is determined by comparing one or more data values associated with one or more related poles in the stored signature and the measured signature.

19. The method of any of claims 1 or 3, wherein the comparing includes determining the covariance of two or more independent variables associated with one or more of the stored signature and the measured signatures.

20. The method of any of claims 1, 3, 5-7, 11, 18, or 20 wherein the signatures are signatures for an entire tire.

21. The method of any of claims 1, 3, 5-7, 11, 18, or 20 wherein the signatures are signatures for less than an entire tire.

22. The system of any of claims 2, 4, 8-10, 12, or 19 wherein the signatures are signatures for an entire tire.

23. The system of any of claims 2, 4, 8-10, 12, or 19 wherein the signatures are signatures for less than an entire tire.

24. The method of any of claims 1, 3, 5-7, 11, 18, or 20 wherein the signatures correspond to four magnetic poles of the tire.

25. The system of any of claims 2, 4, 8-10, 12, or 19 wherein the signatures correspond to four magnetic poles of the tire.